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ABSTRACT

A test scoring system was developed, composed of an optical mark sense card reader (Chatsworth Data Corporation) interfaced with a microcomputer (TRS-80 Model I) that provided the opportunity to do extensive diagnostic and course material testing with item analysis. This system reduced the amount of time required to determine the suitability of test items and identify difficult topics for students of varied abilities. The system was a less expensive alternative to purchasing a test scoring machine, which was incapable of providing extensive item analysis. The system hardware, software, and answer card design are described in detail. Many versions of the test scoring and item analysis (TSIA) program, written in BASIC, are currently in use. The author describes his operating experience with the system over a 9-month period. (DWH)

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MICROCOMPUTER CARD READER SYSTEM for TEST SCORING and ITEM ANALYSIS

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TITLE: Microcomputer Card Reader System for Test Scoring and Item Analysis

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ABSTRACT

Describes a system composed of an optical mark sense card reader (Chatsworth Data Corporation) interfaced with a microcomputer (TRS-80 Model I) that provides the opportunity to easily do extensive diagnostic and course material testing with item analysis. The use of such a system dramatically reduces the amount of time required to determine the suitablility of individual test questions and to identify topics of particular difficulty for students of differing abilities. The total cost of the system, including the microcomputer, is well below $5,000.

In recent years the trend of increased college teaching loads coupled with the decline in the quality of students has made the problem of identification of individual student needs and the development of appropriate course materials even more difficult than it has been in the past. During the past year, I have developed a system composed of an optical mark sense card reader interfaced with a microcomputer that provides the opportunity to do extensive diagnostic and course material testing with item analysis. The use of such a system dramatically reduces the amount of time required to determine the suitability of individual test questions and to identify topics of particular difficulty for students of different abilities.

While a system composed of an optical mark sense card reader that can read standard size sheets of paper at high speed interfaced with a large computer may be the perferred system, the tight budget restrictions of recent times do not make this option feasible for most of us. Test scoring machines costing in the range of $1000 to $3500 are available. However, none of these machines can provide extensive item analysis. The system I have been using consists of a Chatsworth Data Corporation model MR500 card reader, a Radio Shack TRS-80 Model I computer, and an Integral Data Systems Model 440 printer. Total cost of the system is approximately $4200. For people presently owning a microcomputer, however, the additional cost of the card reader is about $1100.

A further advantage of this sytem, when compared to a test scoring machine, is the availability of the microcmputer for faculty and student use when it is not needed for test scoring.

SYSTEM HARDWARE

The Charsworth card reader can read pencil marks on standard or extra long computer cards. Twelve read probes sense marks at the standard Hollerith spacing and another read probe senses printed marks along one edge of the card. Standard computer cards with answer blanks for 50 multiple choice questions or special long cards with room for 100 questions are used. The card reader generates two binary images for each column on the card. The first binary image covers the top six rows and the second image covers the bottom six rows of the twelve row Hollerith format.

ANSWER CARD DESIGN

The printed card design provides space for writing test infromation (student name, course, date, etc.). It also provides squares for the student to fill in his or her identification number and answer card number. If more than 100 questions are being used in an exam, several answer cards can be used for each student. Specially designed cards for questionnaires and other nonstandard uses can be printed using the instructions provided by the Chatsworth company.

SOFTWARE

The applications for such a system can be illustrated by some of the programs that I have developed. These include a program to tabulate the responses of a student evaluation-of-faculty questionnaire; a set of general test scoring and item analysis programs; a program which provides feedback to students on missed items and that includes data on what material should be studied to correct deficiencies; and a book keeping program that does much of the work in a

PSI programmed instruction course. The test scoring and item analysis programs will be discussed in some detail below.

TEST SCORING AND ITEM ANALYSIS PROGRAM

Several versions of the test scoring and item analysis (TSIA) program, written in BASIC, are currently in use. All of the programs provide information on how many items each student missed as well as a list of the items missed. Summary statistics including a bar graph of results are also provided. Item analysis information includes the number of responses to each alternative for each item as well as the number and percent of incorrect responses to each. The mean and standard deviation of test scores as well as the Kuder-Richardson formula 21 is printed. And finally, output is provided for each student including their total score and a list of the items missed as well as the correct alternative for missed items.

One version of these programs provides output that includes the student's name as well as his or her ID number. (Names must, of course, be entered on a disk file at the beginning of the term to be retrieved later from the ID number that students put on their papers.) An even more elaborate version of this program provides inforamtion to the student about where to look for the correct answer to items missed. Such inforamtion must also be entered into a disk file before the exams are corrected.

When using a disk file for temporary storage, it is possible to handle exams with several hundred items and several hundred hundred students. Without the second disk unit for stoarge, the number of students times the number of items is limited to about 20

OPERATING EXPERIENCE

The current system has been in use about nine months and so far has proven to be quite reliable. A set of instructions has been developed for using the

system and undergraduate student assistants with little or no computer experience have had no difficulty learning to use the equipment. The system runs reasonably fast with total time needed to process a test, including reading in each test card and waiting for the printout (actually the process that takes the longest time), averaging about one-half min per student. The biggest problem has been that everyone wants to use the sytem and at times the computer has had to be scheduled several days in advance! A second problem has been that as the faculty becomes aware of what the machine can do, they want to use it for more and more projects thus leading to even more overcrowding. This increased interest has lead to several new projects that will increase the amount of data provided by the compuer. For example, differential item analysis for students at different levels of competence is currently under development. And perhaps our most most ambitious project is the development of a set of programs to take most of the work out of a PSI style course. Such a program would enable a student to take an exam and mark the answers on a comptuter card. The card would then be inserted into the reader and processed by the computer. The computer would not only correct the exam and update the student's file but would provide remedial help in the form of a printout if the student did not pass the exam at the required level. Students who did very weil might even be invited to move on to more difficult material. And of course, the teacher would be kept up to date as to the progress of all his or her students even though they might be working at quite different rates. Such a set of programs is now underdevelopment and we hope to implement them in the spring. Given the power of such a system, the potential for its use is only limited by our imagination.